THE CONTINUUM OF M31 IN THE NUCLEAR BULGE

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Sandage, Becklin, and Neugebauer (1969) have confirmed and extended the color aperture relation for M 31 over the region within 1′ from the nucleus first reported by de Vaucouleurs and Tifft (de Vaucouleurs 1961). In view of the importance of the spectral energy distribution of M31 in determining the K correction, and also the possible variation of stellar content with distance from the nucleus, we have extended these measurements to larger apertures.

The observations were made with the 200-inch prime-focus scanner used with the 4-inch telescope, which is in turn mounted on the 18-inch Schmidt, at Palomar Mountain. A cooled Ascop 541B phototube with pulse counting equipment was used. The observations were made as close as possible to new moon in October and December 1969. Because it is possible that the chemical composition varies over the surface of the galaxy, we have used eleven bandpasses, each 20 Å wide, from 3448 to 5300 Å, chosen to be relatively free of lines. The instrument has a star-sky chopper, and with the nucleus of the galaxy at the center of the southern aperture, the second aperture is 40′ north, in a region which is representative of the general background of stars. Since our apertures are so large, the use of the chopper does not introduce the problem of selecting a representative comparison field. The telescope (18-inch Schmidt) tracks so well that guiding is unnecessary for long intervals of time.

Measurements in the eleven bandpasses were made for five pairs of apertures, ranging from 4.′0 to 16.′7 in diameter. In each case the nucleus was in the center of the southern aperture. The observations were reduced to the calibration of Oke and Schild (1970*a*).

The derived color indices are the same for all the apertures to within $\pm 0^{m}.05$. Because our apertures are concentric circles rather than concentric rings, the actual maximum possible variation in color index, averaged over regions 4′ in size, is approximately $\pm 0^{m}.13$. These color indices, averaged for all the apertures, are listed

TABLE I

AVERAGE COLOR INDICES OF THE NUCLEAR BULGE OF M31

λ(Å)	AB_{70}
5300	−0.27
5050	0.00
4500	+0.23
4400	0.52
4270	0.77
4015	93
3910	1.53
3860	1.95
3620	1.97
3570	2.26
3448	+2.35

TABLE II

MAGNITUDE AT 5050 Å

Diameter	m_{5050}
4'.0	6.84
6'.0	6.17
8'.1	5.93
11'.6	5.71
16'.7	5.37

in Table I, and in Table II we give the magnitude obtained with each aperture at 5050 Å. Furthermore, the color indices given in Table I are in excellent agreement with a scan of the central 10″ of M 31, made with a 50 Å bandpass, published by Oke and Sandage (1968). It is strange that we do not seem to observe any color-aperture effect between our data and those of Oke and Sandage (1968), while with broadband photometry Sandage et al. (1969) saw an effect of about $0^m.2$. Because of the wide spacing and size of the apertures, the data are not capable of yielding an accurate luminosity profile of the area observed.

We have studied the region in M 31 which one might expect to be comparable to the giant ellipticals, namely the nuclear bulge. If one goes further out in the spiral, problems of nonhomogeneity due to the presence of arms become increasingly important. Our data show no noticeable change in color in the continuum over this region, which corresponds to a radius of 1.7 kpc from the center of M 31; while Oke and Schild (1970*b*) find large color changes in the giant ellipticals such as M 87, where they have compared measurements of the nucleus with those including the whole galaxy, whose radius (using the diameter given by de Vaucouleurs (1961) and a Hubble constant of 100 km/sec/mpc) is about 6 kpc.

We therefore conclude that the purest sample of Population II stars that can be found in M 31, namely the region of the nuclear bulge, has some properties which are different from those of the giant ellipticals, and hence may have a different evolutionary history. It is not clear whether M 31 and the giant ellipticals would appear more similar if one could remove the Population I component of the arms and thus reach larger values of *r*. This will be very difficult to determine observationally.

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RADIAL VELOCITIES FROM RECENT SPECTROGRAMS OF U OPHIUCHI AND β AURIGAE

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U Ophiuchi ($5^{m}\!.8$, B5) and β Aurigae ($1^{m}\!.9$, A2) are among the brightest eclipsing binaries. Their double-lined spectra are relatively free of complications, and velocity curves for both systems were